ORIGINAL RESEARCH

International Journal of Surgery 12 (2014) 56–59

Contents lists available at ScienceDirect

International Journal of Surgery

journal homepage: www.journal-surgery.net

Original research

Feasibility and functional efficacy of distal gastrectomy with jejunal interposition for gastric cancer: A case series

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ARTICLE INFO

Article history:
Received 18 July 2013
Received in revised form
16 October 2013
Accepted 24 October 2013
Available online 5 November 2013

Keywords:
Gastric cancer
Jejunal interposition
Reconstruction

ABSTRACT

Introduction: Distal gastrectomy with jejunal interposition (DGJI) has been used in our institution for selected patients with gastric cancer as a function-preserving gastrectomy. The aim of this retrospective study was to clarify the feasibility and functional efficacy of DGJI.
Methods: A retrospective analysis was performed in 61 patients who underwent DGJI between 2002 and 2011.
Results: Mean operation time was 393.8 min and blood loss was 463.3 ml. Postoperative early major complications developed in 2 (3.3%) patients. The most common complication was gastric stasis, occurring in 7 (11.5%) patients. All patients with complications recovered with conservative treatment, and no operative mortality occurred. Endoscopy 1 year after operation revealed reflux gastritis in 1 patient. Reflux esophagitis was not found in any patient. However, anastomotic ulcer was found in 12 (22.2%) patients over the 1-year period after operation. No patient reported symptoms of early and late dumping syndrome, and 1 (1.9%) patient self-reported diarrhea.
Conclusions: DGJI was a feasible and safe procedure with several advantages in terms of less incidence of reflux gastritis and esophagitis, dumping syndrome and diarrhea. However, this procedure is complicated and time-consuming, and it is necessary to be aware of the potential occurrence of an anastomotic ulcer at the site of the gastrojejunostomy after DGJI.

1. Introduction

Although gastric cancer is one of the most common causes of cancer death worldwide,[1] early gastric cancer has accounted for nearly 50% of all gastric cancers in Japan.[2] Early gastric cancer has an excellent prognosis after surgical treatment, with 5-year survival rates of more than 90%. Japanese surgeons have therefore focused on symptom relief to improve the quality of life of long-term survivors. This has led to function-preserving surgery to minimize postgastrectomy syndrome, which includes symptoms such as postoperative weight loss, diarrhea, early and late dumping syndrome, and bile reflux gastritis and esophagitis.

In our institution, distal gastrectomy with jejunal interposition (DGJI) has been used as a function-preserving surgery for selected patients with gastric cancer since January 1994. We also reported the benefit of this procedure in a small comparative study in 2000.[3] Since that report, sentinel lymph node biopsy[4] has been added to this procedure, and the celiac branch of the vagus nerve has also been preserved in selected patients from 2002. We retrospectively analyzed 61 serial patients who underwent DGJI between 2002 and 2011 at our institution to clarify the feasibility, safety, and postoperative functional result of this procedure.

2. Methods

Between 2002 and 2011, 215 patients with gastric cancer underwent surgery at Arita Gastrointestinal Hospital, Oita, Japan. During this period, we performed DGJI in 61, Roux-en-Y (RY) reconstruction in 38, Billroth I in 6, and pylorus-preserving gastrectomy (PPG) in 34 patients. As well, total gastrectomy was performed in 32, proximal gastrectomy in 20, and wedge resection in 24 patients. This study enrolled the 61 patients who underwent DGJI. Our indications for DGJI were as follows: (1) early cancer located in the lower third of the stomach (contraindication for PPG and endoscopic submucosal dissection according to the gastric cancer treatment guideline[5]); (2) advanced cancer without lymph node metastasis by preoperative assessment; and (3) without severe general health problems and history of other disease.

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http://dx.doi.org/10.1016/j.ijsu.2013.10.012

Preoperative assessment was made by endoscopy, ultrasonography, and computed tomography for characterization of the tumors. Information was collected from the medical chart and anesthesia records and included patient age, sex, body mass index, American Society of Anesthesiologists physical status, rates of sentinel lymph node biopsy and preservation of the celiac branch of the vagus, duration of operation, estimated blood loss, blood transfusion, pathological findings, postoperative early and late complications, and recurrence and survival rates. The pathological findings were assessed in accordance with criteria outlined by the Japanese Gastric Cancer Society.[6]

2.1. Operative technique

Sentinel lymph node biopsy was performed as reported previously.[4] DGJI was performed according to our previous report.[3] In brief, a 10–12 cm section of jejunum, which was prepared at a point 20–30 cm distal from the ligament of Treitz, was brought through the transverse mesocolon, and was anastomosed in an isoperistaltic orientation to the greater curvature of the stomach and duodenum with a single layer of interrupted sutures (Fig. 1). Both gastrojejunal and jejunoduodenal anastomoses were performed end to end.

2.2. Definitions of postoperative early complications

Postoperative minor complications were defined as either any abdominal finding during the postoperative course not requiring medication or a systemic complication requiring pharmacologic treatment. Major postoperative complications were defined as any complications requiring surgical or radiological intervention.

2.3. Assessment of postoperative late complications

Patients underwent follow-up examinations every 3 months for 2 years after surgery and every 6 months thereafter. Seven patients were excluded from the assessment of postoperative late complications 1 year after operation because of inadequate postoperative data. The presence of body weight change, dumping syndrome, and diarrhea were assessed via self-reporting, and reflux gastritis, esophagitis, and the presence of anastomotic ulceration were assessed endoscopically 1 year after surgery. Reflux gastritis and esophagitis were assessed endoscopically according to the degree of epithelial redness and erosion present.

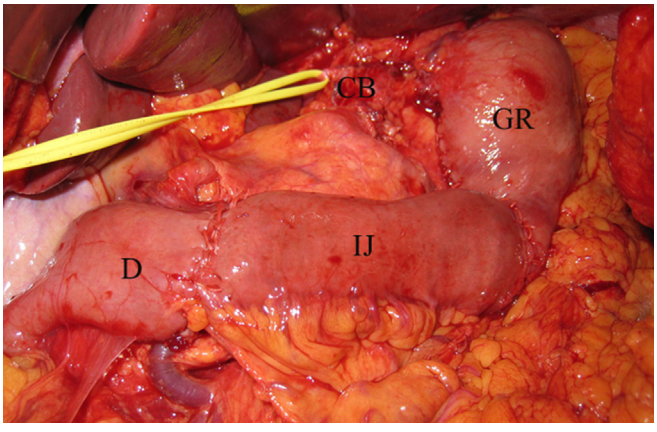

Fig. 1. Operative photograph shows distal gastrectomy with jejunal interposition. A 10–12-cm section of the jejunum was brought through the transverse mesocolon and anastomosed in an isoperistaltic orientation to the greater curvature of the gastric remnant and duodenum. GR, gastric remnant; IJ, interposed jejunum; D, duodenum; CB, celiac branch of the vagus.

2.4. Statistical analysis

Values are expressed as mean ± standard deviation. Survival rates were calculated by the Kaplan–Meier method.

3. Results

There were 44 were men and 17 women with a mean age of 61.5 ± 10.8 (range 32–78) years and mean body mass index of 22.7 ± 2.8 (range 17.3–28.4) kg/m^2 (Table 1). All operations were carried out with curative intent. Sentinel lymph node biopsy was performed in 47 (77.0%) patients, and the celiac branch of the vagus nerve was preserved in 58 (95.1%) patients. The duration of operation was 393.8 ± 89.0 (range 265–580) min, blood loss was 436.3 ± 232.7 (range 94–1281) ml, and 1 (1.6%) patient required perioperative blood transfusion. The number of harvested nodes was 31.1 ± 15.8 (range 6–71), and the incidence of nodal involvement was 26.2% overall (16 of 61 patients). According to the pathological findings, 40 patients had stage IA disease, 6 had stage IB, 6 had stage IIA, 6 had stage IIB and 3 had stage IIIA disease (Table 2). Postoperative oral adjuvant chemotherapy was administered in 16 patients (26.2%). Median follow-up time was 47 (range 3–124) months. Five patients developed recurrence, and 4 died as a result of peritoneal metastasis. One patient developed liver metastasis but was still alive at the time of writing. The overall 5-year survival rate was 88.1%.

Postoperative early complications developed in 11 (18.0%) patients. Major complications occurred in 2 patients: anastomotic leakage in 1 (1.6%) and deep vein thrombus in 1 (1.6%). The patient with anastomotic leakage was cured by conservative therapy using radiographic intervention. Gastric stasis, the most frequent complication, occurred in 7 (11.5%) patients, all of whom had symptoms requiring fasting and intravenous fluid support. Total parenteral nutrition was not used in any of these 7 patients with gastric stasis. All patients with early complications recovered with conservative treatment, and no operative mortality occurred (Table 3).

The assessment of postoperative late complications 1 year after operation is shown in Table 4. The body weight ratio 1 year after surgery was 94.1 ± 8.0 (range 72–109.5) per cent. Bile reflux gastritis was found in 1 (1.9%) patient, but reflux esophagitis was not found in any of the 54 patients by endoscopy at 1 year after operation. However, anastomotic ulcer was found in 12 (22.2%) patients during the 1-year period after operation. No patient reported symptoms of early and late dumping syndrome, and 1 (1.9%) patient self-reported diarrhea.

4. Discussion

A recent report by The Japanese Society for the Study of Postoperative Morbidity after Gastrectomy (JSSPMG)[7] clarified

Table 1
Background of the 61 patients who underwent distal gastrectomy with jejunal interposition.

Characteristics	Values
Age (years)[a]	61.5 ± 10.8 [32–78]
Sex ratio (M:F)[b]	44 (72.1):17 (27.9)
Body mass index (kg/m^2)[a]	22.7 ± 2.8 [17.3–28.4]
ASA[c] physical status	
1	44 (72.1)
2	17 (27.9)

[a] Values are mean ± standard deviation [range].
[b] Values are number (%).
[c] ASA, American Society of Anesthesiologists.

Table 2
Clinicopathological details of the 61 patients who underwent distal gastrectomy with jejunal interposition.

Factors	Values
Sentinel lymph node biopsy (%)[a]	47 (77.0)
Preservation of celiac branch of the vagus (%)[a]	58 (95.1)
Duration of operation (min)[b]	393.8 ± 89.0 [265–580]
Blood loss (ml)[b]	436.3 ± 232.7 [94–1281]
Blood transfusion (%)[a]	1 (1.6)
Number of harvested nodes[b]	31.1 ± 15.8 [6–75]
Nodal involvement (%)[a]	16 (26.2)
Stage	
IA	40
IB	6
IIA	6
IIB	6
IIIA	6

[a] Values are number (%).
[b] Values are mean ± standard deviation [range].

the current status of reconstruction after distal gastrectomy in Japan. According to their report, the most common methods of reconstruction after distal gastrectomy were Billroth I in 77%, RY in 21%, PPG in 1.3%, and Billroth II in 0.7% of patients. Recently, according to the questionnaire survey reported by the JSSPMG,[7] the frequency of RY after distal gastrectomy has been gradually increasing due to benefits such as the prevention of reflux and the low complication rate. However, RY reconstruction is known to cause RY stasis, reported in 71% of patients by the responders to the questionnaire.[7] In addition, Ishikawa et al.[8] reported that RY did not prevent esophagitis in their randomized controlled trial because RY induced RY stasis as a complication. PPG is also a function-preserving procedure devised by Maki and colleagues[9] in 1967. According to previous reports,[10,11] PPG offers many benefits over conventional distal gastrectomy with Billroth I anastomosis, with a low incidence of postgastrectomy syndrome. However, a recent study[12] reported that symptoms after PPG were better in those patients in whom the antral cuff was longer than 1.5 cm, as Maki et al. had noted in their original article describing PPG.[9] Indications for PPG are limited because the gastric cancer treatment guideline[5] states that PPG may be considered in T1 and N0 patients when the tumor is located in the middle third of the stomach with its distal edge greater than 4 cm from the pylorus. Therefore, PPG should not be performed in patients especially when the tumor is located in the lower third of the stomach.

Jejunal interposition between the gastric remnant and the duodenum (gastrojejunoduodenostomy) was first described by Henley.[13] Several other authors[14,15] have also reported the use of jejunal interposition for prevention of reflux gastritis and esophagitis. We previously demonstrated favorable results of DGJI[3] and concluded that this procedure is an acceptable surgical modality for selected patients with gastric cancer. Although DGJI has several functional advantages compared with the Billroth I anastomosis, there exist some disadvantages for the use of DGJI in all patients with gastric cancer in that this surgical procedure requires three anastomoses compared with one in the Billroth I anastomosis, resulting in longer operation time and greater blood loss according to our previous report.[3] Therefore, we performed this procedure in 61 selected patients who were without severe general health problems and history of other disease and in whom prediction of prognosis was excellent due to meticulous preoperative assessment.

Table 3
Postoperative early complications in the 61 patients after distal gastrectomy with jejunal interposition.

Complications	Values
Major complications	
Anastomotic leakage	1 (1.6)
Deep vein thrombus	1 (1.6)
Minor complications	
Gastric stasis	7 (11.5)
Lymphatic leakage	1 (1.6)
Cholecystitis	1 (1.6)
Total	11 (18)

Values are number (%).

Table 4
Postoperative late complications in 54 patients 1 year after distal gastrectomy with jejunal interposition.

Findings	Values
Ratio of body weight change (%)[a]	94.1 (8.0) [72–109.5]
Endoscopy[b]	
Reflux gastritis	1 (1.9)
Reflux esophagitis	0 (0)
Anastomotic ulcer	12 (22.2)
Dumping syndrome[b]	0 (0)
Diarrhea[b]	1 (1.9)

[a] Value is mean ± standard deviation [range].
[b] Values are number (%).

DGJI is a complicated procedure because it requires three anastomoses compared with the one required in a Billroth I reconstruction. The present study showed that postoperative early complications developed in 18.0% of the patients. However, major complications requiring surgical or radiological intervention occurred in only 3.3% of the patients. In addition, the patient with anastomotic leakage was cured by radiographic intervention. The most frequent early complication was gastric stasis, occurring in 11.5% of patients, of whom all recovered with temporary fasting and intravenous fluid support. The rate of gastric stasis was considered acceptable compared with reported rates of RY stasis of 71.0% and of gastric stasis of 8.0% in PPG.[16] In terms of postoperative early complications, we therefore considered DGJI to be a safe procedure.

We demonstrated favorable functional results 1 year after DGJI: there were low rates of weight loss, dumping syndrome, diarrhea, and reflux gastritis and esophagitis. However, endoscopy performed during the 1 year after operation revealed that 12 (22.2%) of 54 patients had anastomotic ulcer at the site of the gastrojejunostomy. The mechanism and cause of anastomotic ulceration were not well understood because the number of patients who underwent DGJI in the present study was very small. Although all patients with anastomotic ulceration were cured by medication using a histamine 2 receptor antagonist or proton pump inhibitor, further accumulation of cases and examinations is necessary to clarify the mechanism and cause of anastomotic ulcer after DGJI.

We previously reported the benefits of DGJI using retrospective data in 20 patients who underwent DGJI.[3] To our best knowledge, there have been no reports on the feasibility and efficacy of DGJI since our previous report. Therefore, the present study might be helpful in terms of showing the recent surgical outcomes of DGJI by analyzing 61 patients who underwent DGJI. However, the present study has some limitations. This was retrospective case series. We did not examine the superiority or inferiority of DGJI in comparison with conventional reconstruction (Billroth I and RY) because the clinical background of the patients was different between these three procedures (DGJI, Billroth I, and RY). The reason why was that since 2002, we have performed conventional reconstruction only in patients with severe general health problems and a history of other disease and in whom a poor prognosis was predicted by

preoperative assessment. Further prospective studies with stratified randomization are needed to confirm the surgical outcomes of DGJI.

5. Conclusion

Despite some limitations, our study showed that DGJI was feasible and offered several advantages in terms of less postoperative weight loss and low rates of reflux gastritis and esophagitis, dumping syndrome, and diarrhea compared with other reconstruction procedures. DGJI can therefore be recommended as a valid option following distal gastrectomy. However, DGJI should be indicated only for those patients without severe general health problems and history of other disease because it is complicated and time-consuming. Additionally, it is necessary to be aware of the potential occurrence of an anastomotic ulcer at the site of the gastrojejunostomy after DGJI.

Ethical approval

None.

Funding

None.

Author contribution

S Ninomiya – main operating surgeon and writing.
T Arita - all aspect of the study.
K Sonod - main operating surgeon and data collection.
T Bandoh - main operating surgeon and data analysis.
H Shiroshita - main operating surgeon and data analysis.
M Tajima - study design and writing.

Conflict of interest

None.

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